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**INTERNATIONAL PRELIMINARY EXAMINATION REPORT**



(PCT Article 36 and Rule 70)

Applicant's or agent's file reference P02PB020/PCT	<b>FOR FURTHER ACTION</b> See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)	
International application No. <b>PCT/KR2002/002268</b>	International filing date (day/month/year) <b>02 DECEMBER 2002 (02.12.2002)</b>	Priority date (day/month/year)
International Patent Classification (IPC) or national classification and IPC  <b>IPC7 C02F 3/06, C02F 3/10</b>		
Applicant <b>KOREA INSTITUTE OF CONSTRUCTION TECHNOLOGY et al</b>		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.
2. This REPORT consists of a total of 3 sheets, including this cover sheet.
- ☒ This report is also accompanied by ANNEXES, i.e., sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

These annexes consist of a total of 7 sheets.

3. This report contains indications relating to the following items:
- I ☒ Basis of the report
  - II ☐ Priority
  - III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
  - IV ☐ Lack of unity of invention
  - V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
  - VI ☐ Certain documents cited
  - VII ☐ Certain defects in the international application
  - VIII ☐ Certain observations on the international application

Date of submission of the demand  <b>17 JUNE 2004 (17.06.2004)</b>	Date of completion of this report  <b>28 MARCH 2005 (28.03.2005)</b>
Name and mailing address of the IPEA/KR  Korean Intellectual Property Office 920 Dunsan-dong, Seo-gu, Daejeon 302-701, Republic of Korea Facsimile No. 82-42-472-7140	Authorized officer  <b>LEE, Jin Yong</b>  Telephone No. 82-42-481-8116 

# INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.

PCT/KR2002/002268

## I. Basis of the report

### 1. With regard to the elements of the international application:\*

- ☐ the international application as originally filed
- ☒ the description:  
 pages 1-15, as originally filed  
 pages \_\_\_\_\_, filed with the demand  
 pages \_\_\_\_\_, filed with the letter of \_\_\_\_\_
- ☒ the claims:  
 pages \_\_\_\_\_, as originally filed  
 pages \_\_\_\_\_, as amended (together with any statement) under Article 19  
 pages \_\_\_\_\_, filed with the demand  
 pages 16-21, filed with the letter of 04/02/2005
- ☒ the drawings:  
 pages 1/5 - 5/5, as originally filed  
 pages \_\_\_\_\_, filed with the demand  
 pages \_\_\_\_\_, filed with the letter of \_\_\_\_\_
- ☐ the sequence listing part of the description:  
 pages \_\_\_\_\_, as originally filed  
 pages \_\_\_\_\_, filed with the demand  
 pages \_\_\_\_\_, filed with the letter of \_\_\_\_\_

### 2. With regard to the language, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language English which is

- ☐ the language of a translation furnished for the purposes of international search (under Rule 23.1(b)).
- ☒ the language of publication of the international application (under Rule 48.3(b)).
- ☐ the language of the translation furnished for the purposes of international preliminary examination (under Rules 55.2 and/or 55.3).

### 3. With regard to any nucleotide and/or amino acid sequence disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

### 4. ☒ The amendments have resulted in the cancellation of:

- ☐ the description, pages \_\_\_\_\_
- ☒ the claims, Nos. 2
- ☐ the drawings, sheets \_\_\_\_\_

### 5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).\*\*

\* Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this opinion as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17).

\*\* Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.

# INTERNATIONAL PRELIMINARY EXAMINATION

International application No.

PCT/KR2002/002268

## V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

### 1. Statement

Novelty (N)	Claims	1, 3-28	YES
	Claims	NONE	NO
Inventive step (IS)	Claims	1, 3-28	YES
	Claims	NONE	NO
Industrial applicability (IA)	Claims	1, 3-28	YES
	Claims	NONE	NO

### 2. Citations and explanations (Rule 70.7)

Reference is made to the following documents:

D1: EP 882676 A

D2: JP 62-83093 A

The present invention relates to an apparatus and method for performing a tertiary treatment of sewage by using porous filtering media to purify effluent wastewater from a settling basin of a sewage disposal plant and apply the water to wastewater reclamation and reusing system; and more particularly, to an apparatus and method for performing a tertiary treatment of sewage by using porous filtering media, which can remove suspended solids, organic matters and nutritive salts included in the effluent wastewater from a secondary settling basin of a sewage disposal plant simultaneously by filling a settling and filtering basin with porous filtering media having large surface area and an opening.

D1 relates to a carrier separating screen of a wastewater treatment utilizing a microbe-attached air-bubbles supply method/apparatus for the screen and a wastewater treatment method/facility provided with apparatus. The invention particularly relates to a carrier separating screen of a wastewater treatment facility that utilizes a microbe-attached carrier for a biological purification process of organic and inorganic substances contained in a wastewater. The carrier is a particulate that includes a major constituent of an organic polymer substance or an inorganic substance, which holds microbes to effectively purify the wastewater. The carrier holds the microbes that may be built-up thereon or attached thereto; D2 relates to a wastewater treatment method always holding the concentration of microorganism to a high level, by suspending microorganism carriers supporting microorganism in a treatment tank.

Claim 1 of the present invention directed to an apparatus for performing a tertiary treatment of sewage using porous filtering media, appears to be easily modified from the teaching of D1 and D2 by a person skilled in the art in that it includes a reaction tank into which effluent wastewater of a settling basin flows and porous filtering media having predetermined sizes of surface areas and openings filled in the reaction tank. However, it is considered inventive in that it discloses that the two-step overflow weir installed in the upper surface of the efflux portion of the reaction tank receives the upper and lower flow of the effluent wastewater respectively while discharging the water cleaned in the reaction tank. Claim 21 is also inventive in including the steps of collecting the effluent wastewater from a settling basin, flowing the effluent wastewater through porous filtering media in a fore reaction tank, and processing suspended solids and organic matters based on biological, physical and chemical reactions; treating further the effluent water from the fore reaction tank at a rear reaction tank by porous filtering media; and discharging through the two-step overflow weir receiving the upper and lower flow of the effluent wastewater respectively.

Claims 3-20, 27-28, dependent on claim 1, and claims 22-26 dependent on claim 21 are also inventive under PCT Article 33(2)-(3).

Claim 1 and claims 3-28 of the present invention are industrially applicable under PCT Article 33(4).

What is claimed is:

1. An apparatus for performing a tertiary treatment of sewage using porous filtering media,  
5 comprising:

a reaction tank into which effluent wastewater of a settling basin flows;

porous filtering media having predetermined sizes of surface areas and openings and filled in the reaction tank,  
10 for removing suspended solids by precipitating suspended solid particles included in the effluent wastewater and removing organic matters and nutritive salts included in the suspended solid particles along with the precipitation removal of the suspended solid particles.

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2. The apparatus as recited in claim 1, further comprising:

an overflow weir installed in the upper surface of the efflux portion of the reaction tank, for discharging  
20 the water cleaned in the reaction tank to the outside.

3. The apparatus as recited in claim 1, wherein the porous filtering media are formed of waste plastics or plastics having a size of 10 ~ 300mm.

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4. The apparatus as recited in claim 1, wherein the small size of the porous filtering media are filled in the upper part of the reaction tank, and the size of the porous filtering media becomes larger as it goes to the  
30 lower part of the reaction tank.

5. The apparatus as recited in claim 1, wherein the opening rate of the porous filtering media filled in the reaction tank is 50 ~ 90%.

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6. The apparatus as recited in claim 1, wherein the reaction tank includes:

a fore reaction tank, which is filled with the porous filtering media, for collecting the effluent wastewater from the settling basin and performing precipitation based on biological, physical and chemical reactions;

5 a rear reaction tank filled with a predetermined size of porous filtering media, for re-treating the effluent water from the fore reaction tank;

a discharging tank provided with an overflow weir on one side of the upper part of the efflux portion, for  
10 retaining and discharging the secondary effluent water from the rear reaction tank; and

rectifying walls having a plurality of efflux openings for partitioning the fore reaction tank, rear reaction tank and discharging tank.

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7. The apparatus as recited in claim 6, wherein the filtering media filled in the fore reaction tank are formed of a predetermined size of porous filtering media.

20 8. The apparatus as recited in claim 6, wherein the filtering media filled in the fore reaction tank are formed of any one selected from a group consisting of aluminum sulfate, iron salt, lime and polymer coagulant.

25 9. The apparatus as recited in claim 6, further including:

a highly pure oxygen injection means, installed in the lower part of the fore reaction tank, for inducing phosphorous removal and denitrification.

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10. The apparatus as recited in claim 6, further including:

an ozone injection means, installed in the lower part of the fore reaction tank, for inducing phosphorous  
35 removal and denitrification.

11. The apparatus as recited in claim 9, wherein

the diameter of the porous filtering media in the fore reaction tank is 50 ~ 300 mm.

12. The apparatus as recited in claim 6, wherein  
5 the diameter of the porous filtering media in the rear reaction tank is 10 ~ 200 mm.

13. The apparatus as recited in claim 6, wherein  
the opening rate of the porous filtering media filled in  
10 the fore and rear reaction tanks is 50 ~ 90%.

14. The apparatus as recited in claim 6, wherein  
the porous filtering media are formed of plastics including  
waste plastics.

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15. The apparatus as recited in claim 6, wherein  
the size of the porous filtering media in the fore part of  
the rear reaction tank is large, and the size of the porous  
filtering media becomes smaller as the porous filtering  
20 media goes to the rear part.

16. The apparatus as recited in claim 6, further  
including:

25 sludge retention tanks installed in the lower parts  
of the fore and rear reaction tanks, respectively, for  
collecting and removing the sludge produced during the  
sewage treatment process.

17. The apparatus as recited in claim 6, further  
30 including:

an air supplier installed in the lower part of the  
rear reaction tank, for removing the sludge produced during  
the sewage treatment process.

18. The apparatus as recited in claim 6, further  
35 including:

a supersonic generator installed in the lower part of

the rear reaction tank, for removing the sludge produced during the sewage treatment process.

19. The apparatus as recited in claim 6, wherein  
5 the area of the influx portion of the fore reaction tank is formed larger than the area of the efflux portion of the rear reaction tank to make the speed of a current uniformly distributed in the fore and rear reaction tanks.

10 20. The apparatus as recited in claim 6, further including:

an upper rectifying wall, which has a plurality of efflux openings and is extended to the inner side of the rear reaction tank from a predetermined area of the  
15 rectifying wall that partitions the rear reaction tank and the discharging retention tank, for minimizing the dead space area of the rear reaction tank.

21. A method for performing a tertiary treatment of  
20 sewage using porous filtering media, comprising the steps of:

a) collecting the effluent wastewater from a settling basin, flowing the effluent wastewater through porous filtering media having predetermined sizes of surface areas  
25 and openings and filled in a fore reaction tank, and processing suspended solids and organic matters based on biological, physical and chemical reactions;

b) taking in the rear reaction tank the effluent water cleaned in the fore reaction tank, flowing the  
30 cleaned water through the porous filtering media having predetermined sizes of surface areas and openings and filled in the rear reaction tank, and removing suspended solids and organic matters based on biological, physical and chemical reactions; and

35 c) retaining the water discharged from the rear reaction tank in the discharging tank and discharging the water through an overflow weir.

22. The method as recited in claim 21, further comprising a step of:

d) removing nitrogen and phosphorous included in the suspended solids by getting rid of the sludge precipitated  
5 in the fore and rear reaction tanks periodically.

23. The method as recited in claim 21, further comprising a step of:

e) inducing the oxidation and nitrification of the  
10 organic matters by supplying dissolved oxygen to the fore reaction tank, and then promoting denitrification reaction in the rear reaction tank.

24. The method as recited in claim 21, further  
15 comprising a step of:

f) removing the organic matters by supplying ozone ( $O_3$ ) to the fore reaction tank to promote the biodegradation of the organic matters which are not decomposed easily, increasing the efficiency of removing  
20 coagulated particles and inducing nitrification, and promoting denitrification in the rear reaction tank.

25. The method as recited in claim 21, further comprising a step of:

25 g) coagulating and precipitating the dissolved phosphorous by adding a coagulant to the fore reaction tank to increase the effect of removing the suspended solids.

26. The method as recited in claim 21, further  
30 comprising a step of:

h) cleaning and removing the sludge attached on the porous filtering media periodically by providing air or supersonic from the lower part to the upper part of the fore and rear reaction tanks.